Extracts of two Letters, Written by Dr. Garden *of* Aberdeen; *one concerning the Cauſes of ſeveral* Winds, *&c. to Dr.* Plot: *the other concerning the* Proboſcis *of* Bees; *&c. to Dr.* Middleton.

Extract of the firſt Letter.

THO the Obſervations I have yet by me concerning *Weather* be both few and of no great moment, yet I cannot refuſe to impart them to the *Philoſophical Society*, being they are pleas'd to call for them. They are ſuch as I doubt not they have heard of already, and I give my conjecture about them meerly to excite others to enquire more narrowly into the truth of the matters of fact, and from what cauſes they may proceed. They relate cheifly to the *Weather* between the *Tropicks*, and I preſume to tranſmit them to you in this paper and ſhall range them under theſe heads. 1. Concerning the winds which under the Line blow continually from Eaſt to Weſt. 2. Anent the Weſtern winds which are ſtill to be found for ſome degrees on this ſide the *Tropick*. 3. Concerning the ſtated changes of the Eaſtern winds, blowing the one half of the year from the North-Eaſt and the other half from the South-Eaſt. 4. Concerning the ſtated Winters and Summers which are to be found at one time in diſtant places of one and the ſame *Countrie*. 5. The ſingularity of *Peru* as to this beyond any other part of the Earth. 6. Concerning the ſtrong and laſting winds which blow over almoſt all the known Earth about the *Æquinoxes*

As to the firſt, it is generally known that there are continual Eaſtern winds under the line which they call *Briſes*, and therefore the accounts of *Spaniſh* Voyages bear, that in their going to the Weſt-*Indies* they ſail Southwards from *Spain* along the Coaſt of *Africk*, till they be beyond the *Tropick* of *Cancer* within 20 degrees of the line, where they preſently find an Eaſterly wind, and

and ſo they ſail on Weſtwards with full winds, ſo as they have ſcarce any need to touch their ſails in the whole Voyage: and this they give as the reaſon why the Voyage from *Spain* to the Weſt-*Indies* is ſhorter, more eaſie and more aſſured than the return to *Spain*. In the South *Sea* alſo going from new *Spain* or *Peru* to the *Philippines* or *China*, their Voyage is eaſie ſailing always from Eaſt to Weſt neer the line, where the Eaſterly winds blow in their Poop. *Acoſta* reports that in the year 1584 there went a Ship from *Calloa* in *Lima* to the *Philippines*, which ſailed 2700 Leagues without ſight of Land and this in two months, without want of wind or any torment, and their courſe was almoſt ſtill under the Line. For from *Lima* which is 12 degrees to the South he came to *Manilla* which is as much to the North.

Now theſe continual Eaſterly winds between the *Tropicks* I ſuppoſe to proceed both from the motion of the Earth and the Vertical influences of the *Sun* after this manner. As you know the vaſt fluid and *Æther* in which the Earth floats in its annual motion, moves forward with the Earth in that motion, or rather carries the Globe of the Earth along with it; even ſo the *Atmoſphere* and a large Vortex of *Æther* beyond the *Moon* goes round with the Earth in its diurnal motion, which tho' according as it is removed from the Earth it may be proportionably ſlower in its motion, yet that portion of the *Atmoſphere* which is neareſt the Earth and ſurrounds it, may be ſuppoſed to keep equall pace with the Earth in its motion, and if there were no changes in the *Atmoſpher's Gravity*, I ſuppoſe it would always go along with the Globe of the Earth from Weſt to Eaſt in an uniform motion, which would be wholly inſenſible to us. But that portion of the *Atmoſphere* under the Line being extreamly rarified, its ſpring expanded, and ſo its gravity and preſſure much leſs than the neighbouring parts of the *Atmoſpher*, and conſequently uncapable of the uniform motion to the

Eaſt, it muſt needs be preſt Weſtwards, and make that continual *Briſe* from Eaſt to Weſt between the *Tropicks*. As to the ſecond, the ſame accounts bear, that on this ſide the *Tropick* about 28 or 30 degrees there are to be found conſtant Weſterly winds, and therefore the *Spaniſh* fleets from the Weſt *Indies* do not return the way they went, but thoſe both from *Peru* and new *Spain* ſail along the Coaſt Northward till they touch at *Havana* in *Cuba*, and being joyn'd together there, they ſeek their height without the *Tropicks*, where preſently they find Weſterly winds which ſerve them till they come in view of the *Azores*, and from thence to *Sevill*. In like manner in the South Sea thoſe which return from the *Philippines* or *China* to *Mexico*, to the end they may recover the Weſtern winds, mount a great height till they come right againſt the *Iſlands* of *Japan*, and diſcovering *Caliphornia*, they return by the Coaſt of new *Spain* to the port of *Acapulco*, from whence they parted. So that tho' they ſail eaſily from Eaſt to Weſt in both Seas within the *Tropicks*, for that the Eaſtern winds reign there; yet returning from Weſt to Eaſt they muſt ſeek the Weſtern winds without the *Tropicks* in the height of 27 degrees.

Now the reaſon of this ſeems to me clearly deducible from the former; for the preſſure of the *Air* between the *Tropicks* being continually leſs than the neighbouring parts of the *Atmoſphere*, and ſo conſequently by them preſſed Weſtward, way being thereby given to the neighbouring *Air* for ſome degrees without the *Tropicks*, its motion from Weſt to Eaſt is proportionably encreaſt beyond that uniform motion it would have if the whole *Atmoſphere* were of an equall preſſure, and conſequently there will blow a conſtant wind from Weſt to Eaſt for ſome degrees beyond the *Tropicks*.

The third thing I have had occaſion to obſerve is, that by what I can collect from the accounts of Eaſtern Voyages, thoſe Eaſterly winds between the *Tropicks* do not blow

blow conſtantly from the ſame point, nor directly from the Eaſt; but for the one half of the year, to wit from *April* to *November* or thereabouts, they come from the South-Eaſt, and for the other half of the year, *viz.* from *November* to *April*, they blow from the North-Eaſt. And theſe I ſuppoſe they call their Monſons and trade winds. Hence it is that they who ſail from *China*, *Japan*, &c. to *Bantam* muſt wait the Northerly Monſon which falls between *November* and *April*; and they who return from *Bantam* muſt go back again when the Southerly Monſon comes, which is between *April* and *November*. And the Currents of the Seas are ſaid to obſerve the ſame motion, and changes with the winds. I know not whether theſe Monſons do blow exactly from the ſame points in all parts, for it is like where there are *Bays*, highlands and *Iſlands*, &c. the Monſons may blow from different points; but this is cheifly to be underſtood of open Seas.

Now theſe Monſons I think may be eaſily accounted for from what has alreadie been ſaid anent the cauſe of the continual Eaſterly winds between the *Tropicks*; for ſeeing the leſſening of the *Air*'s preſſure under the Line, and the preſſure of the Neighbouring parts of the *Atmoſphere* thereupon occaſion theſe continual *Briſes*, if the *Sun* were conſtantly in the *Æquinoctial Line*, it is like the wind would blow ſtill directly from the Eaſt, but in that he is the one half of the year on the one ſide of the Line and the other half on the other, there muſt of neceſſity follow a change of theſe *Briſes* into ſtated Monſons. For imagine the *Atmoſphere* to be divided into two equal *Hemiſpheres* by the *Æquinoctial Plane*, if the *Sun* were always in the *Plane*, there would be ſtill an equal preſſure from both theſe *Hemiſpheres* upon the *Air* under the Line and the *Briſe* ſhould be directly from the Eaſt. But now when the *Sun* comes on the North ſide of the Line as far as the *Tropick* of *Cancer* and back a-

gain, there is not an equal ballance, but the preſſure of the Southern *Hemiſphere* of the *Air* muſt needs be greateſt, and conſequently the *Briſe* muſt blow all that ſeaſon from the South Eaſt, and when the *Sun* returns again to the South-ward of the Line as far as *Capricorn* and back again, the preſſure of the Northern *Hemiſphere* muſt needs preponderate and make the wind blow all that half year from the North-Eaſt. And this ſeems to accord very well with experience for their Northern Monſons are in our Winter ſeaſon when the *Sun* is in the Southern Signs, and their Southern ones in our Summer when he is in the Northern Signs.

The fourth thing I have mentioned is the ſtated Winters and Summers, which are to be found in diſtant places of the ſame *Countrie* at one and the ſame time. For example the Rivers of *Indus* and *Ganges*, where they enter the *Ocean*, do contain between them a large *Cherſoneſus* which is divided in the middle by a ridge of high hills which they call the *Gate*, which run along from Eaſt to Weſt and quite thorow to the Cape *Comori*. On the one ſide is *Malabar*, and on the other *Coromandel*. On the *Malabar* ſide between that ridge of *Mountains* and the Sea, it is after their appellation Summer from *September* till *April*. In which time it is always a clear skie, without once or very little raining. On the other ſide the hills on the Coaſt of *Coromandel* it is at the ſame time their Winter, everie day and night yeelding abundance of rains; and from *April* to *September* it is on the *Malabar* ſide their Winter, and on the other ſide their Summer, ſo that in little more than 20 Leagues journie in ſome places, as where they croſſe the hills to S^t. *Thomas*, on the one ſide of the hill you aſcend with a fair Summer, on the other you deſcend with a ſtormy Winter. The like is ſaid to be at Cape *Razalgate* in *Arabia*. And Dr. *Trapham* relates the ſame of *Jamaica*, intimating that there is a ridge of hills which runs from

Eaſt to Weſt thro the midſt of the *Iſland*, and that the *Plantations* on the South ſide of theſe hills have from *November* to *April* a continual Summer, whilſt thoſe on the North ſide have as conſtant a Winter, & è contra from *April* to *November*.

From theſe and ſuch like accounts it ſeems evident that a bare leſſening of the *Atmoſphere's Gravity* will not occaſion rain, but that there is alſo needfull either a ſudden change of Winds, or a ridge of hills to meet the *Current* of the *Air* and *Vapours*, whereby the *Particles* of the *Vapours* are driven together and ſo fall down into drops of rain. And hence it is that whilſt the wind blows from the North-Eaſt, *viz.* from *November* to *April*, there are continual rains in the Northerly *Plantations* of *Jamaica* and on the ſide of *Coromandel* in the Eaſt-*Indies*, becauſe the winds beat againſt that ſide of the hills, and ſo there is fair weather on the other ſide of theſe hills, in *Malabar*, and the Southern *Plantations* of *Jamaica*, there being no winds to drive the *Vapours* together. But in the Southerly Monſon, *viz.* from *April* to *November*, *Malabar*, and the Southern Plantations of *Jamaica* have floods of rains, the wind beating againſt that ſide of the hills, whilſt in *Coromandel* and the other ſide of *Jamaica* there is fair and clear weather. The Maps make thoſe *Mountains* of *Gate* run South and North, and if ſo the Monſons muſt blow from other points by reaſon of the neighbouring *Countries* and *Iſlands*, or elſe this is not the true cauſe of theſe ſeaſons.

This ſerves alſo to clear the next thing mentioned, *viz.* the ſingularity of ſeaſons in *Peru* beyond any other parts of the Earth, and ſeems to be aſſign'd by *Acoſta* as the cauſe of it. *Peru* runs along from the Line Southwards about 1000 Leagues. It is ſaid to be divided into three parts, long, and narrow, which they call *Lanos*, *Sierras* and *Andes*; the *Lanos* or plains run along the South Sea Coaſt; the *Sierras* are all hills with ſome *Vallies*; and the

Andes ſteep and craggy *Mountains*. The *Lanos* have ſome ten Leagues in breadth, in ſome parts leſs and in ſome more, the *Sierra* contains ſome 20 Leagues in breadth, the *Andes* as much, ſometimes more, ſometimes leſs, they run in length from North to South, and in breadth from Eaſt to Weſt. This part of the World is ſaid to have theſe remarkable things. 1. All along the Coaſt in the *Lanos* it blows continually with one only wind, which is South and South-Weſt, contrary to that which uſually blows under the torrid *Zone*. 2. It never rains, thunders, ſnows nor hailes in all this Coaſt or *Lanos* tho' there falls ſometimes a ſmall dew. 3. Upon the *Andes* it rains almoſt continually, tho' it be ſometimes more clear than other. 4. In the *Sierra*, which lies betwixt both the extreams, it rains from *September* to *April*, but in the other ſeaſons it is more clear, which is when the *Sun* is fartheſt off, and the contrary when it is neareſt. Now the reaſon of all ſeems to be this. The Eaſtern *Briſes* which blow conſtantly under the Line being ſtopt in their Courſe by the *Sierras* and *Andes*, and yet the ſame *Briſes* being to be found in the South Sea beyond *Peru*, as appears by the eaſie Voyages from *Peru* to the *Philippines*, a Current of wind blows from the South on the plains of *Peru* to ſupply the Eaſtern *Briſe* in the South ſea: and there being but one conſtant Gale in theſe plains, and no contrary winds, nor hills for it to beat upon, this ſeems to be the reaſon why the *Vapours* are never or very ſeldom driven into rain. And the *Andes* being as high perhaps in many places as the *Vapours* aſcend in the higheſt degree of the *Atmoſphere's Gravity*, this may probably be the reaſon why the Eaſtern *Briſe* beating conſtantly againſt theſe hills occaſion rains upon them at all ſeaſons of the year. And the *Sierras* being it ſeems lower than the *Andes*, therefore from *September* to *April*, when the *Sun* is neareſt, and ſo the *Atmoſphere's Gravity* leſs, and the *Vapours* lower, they are driven againſt the *Sierras* into rain.

The

The laſt thing I ſhall offer to your conſideration is anent thoſe ſtrong and laſting winds which uſually fall out about the *Æquinoctials*, and that for any thing I can learn thro' all parts of the known earth. The cauſes of thoſe particular, various, uncertain and unconſtant winds which do blow in the *Countries* without the *Tropicks*, and that moſt frequently in *Mountainous* places and more ſeldom in great *Plains* ſuch as *Poland*, I cannot ſo eaſily conjecture: but thoſe general winds which uſually fall out everie where about both *Æquinoctials*, ſeem to proceed from ſome general cauſe, and this I take to be the change of the *Monſons* and trade winds about theſe times between the *Tropicks*. For there muſt needs be about theſe ſeaſons a change of the *Ballance* of the *Atmoſphere* according to what I have diſcourſed on the third head, and this I think cannot but occaſion ſtrong winds over all the Earth.

Thus, *Sir*, at the deſire of the *Philoſophical Society*, I have preſum'd to trouble both them and you with theſe farther Notes I had by me concerning Weather. The undoubted truth and certainty of all theſe *Phenomena* I cannot warrand; (moſt of them I had from *Purchas* his *Pilgrims*, whoſe Relations do not now paſs for fabulous) far leſs can I aſſert my conjectures to be their true cauſes. I have propoſed both only that I may give you occaſion to employ your *Philoſophical* Correſpondence on this ſubject alſo, and particularly to engage your acquaintances who go to the Eaſt or Weſt *Indies*, to get particular and certain informations of the ſtated Seaſons between the *Tropicks* both as to winds and rains, &c, in the open *Seas*, the *Bayes*, *Continents*, &c; and the particular ſituations of the *Mountains* as to the Quarters of the *Heavens* where thoſe different Seaſons are on their oppoſite ſides; and that your Learned *Society* may continue to

take this ſubject to their particular conſideration, and you may be pleas'd to favour me both with your own thoughts and thoſe of the Reverend Dr. *Wallis* on this head. I do by theſe preſent my moſt humble Service to your meeting and am,

Sir.

Your moſt Affectionate Freind
and Humble Servant
GEORGE GARDEN.

Aberdein
Sept. 4. 1685.

Extract of the ſecond Letter.

Sir,

THere have been two Monſtrous births this year in this place, both *Females*: the firſt was two perfectly form'd Children above and below the belly, having two heads, four arms, and four legs, only the two arms which ſtood next other were not perfectly form'd into hands and fingers, the breaſts beginning to joyn thereabouts; there was but one belly, tho' ſomewhat bigger than ordinary, one *Navel* and *Navel*-ſtring tyed to one after-birth; yet there were four buttocks, two diſtinct fundaments, and the two privities were confounded together. 'Tis thought they might have been brought forth alive, but that they ſtaid long in the birth, for that both heads preſenting together, the *Midwife* thought they had been Twins,

Twins, and thruſt one of them always back. The other had all the due proportions of one Child, the head excepted; it having two heads, the one ſtanding behind the other, the foremoſt leſs than the due proportion, and bowed down upon the breaſt having yellow hair, and wanting nothing of the due proportions of the face ſave one Cheek beneath the ey; the other bigger than ordinary, ſtanding ſomewhat higher, having no face which they ſuppoſe to have been disfigured by the back part of the other. Neither of theſe were opened; the Mothers are alive. I had the account of the firſt from a *Phyſician* who was call'd to the Woman in hard Labour, and ſome women who were aſſiſtants; and the other from two *Midwives* who were preſent.

Upon the *River* of *Don*, a little below the bridge near the *River's* mouth, there is a bank, the face of which is broken down, and it is full of ſtones which one would think were in *fieri*; they are all either round or oval, of different ſizes; the faces of moſt of them are broken off, they are ſoft and will eaſily rub down with your hand, they are of different gritts and colours, and are made up of different ſands and clays mingled together, the clay is ſoft both to hand and taſt, in ſome of them white, in others gray, tho' in ſome places the clay and ſand are hardned to the conſiſtence & colours of ſuch oval ſtones as we uſually ſee in the fields, but where they are at the ſofteſt, the bed that each ſtone lyes in, is alwayes hard and of another gritt and colour. What light this may give to the *Natural Hiſtory* of the formation of ſtones, I ſhall leave to the diſquiſition of others.

There are ſome things, which, tho' inconſiderable in themſelves, yet, may have their own place in the *Hiſtory* of *Nature*, and will not be unacceptable if they have not been taken notice of already; I ſhall only mention one or two of them relating to *Inſects*. Mr. *Leewenhoeck Numb.* 94 and 97 of the *Phil. Tranſ.* was the firſt who gave

gave notice of the five little Inſtruments which are on the head of the *Bee* before, four whereof are two pairs, the one being call'd by him ſcrapers, the other Arms, the fifth he calls the Wiper, ſuppoſing that by it they wipe off the honie from the flowers. This laſt is truly the Sucker or *Proboſcis* being hollow and made up all of Circular *Fibres*, wherewith the *Bee* ſucks the Honey from the flowers.

The *Globulets* which break forth from the Attire of flowers, deſcrib'd by Dr. *Grew* and *Malpighius*, which are all for the moſt part of an oval figure and of different colours, ſome white, ſome yellow, ſome red, ſeem to be bags of Liquors and are the materials which the *Bees* carry in for their wax, as is evident not only from the different colours of the wax upon their legs according to the different colours of the *Globulets* of the reſpective flowers we ſee them light upon, but for that alſo if you take them gathering wax from any particular flower, and view a ſmal parcel of that wax with a *Microſcope* you will find it to conſiſt of the *Globulets* of the ſame flower, tho' it is not not ſo eaſie to diſcover what Liquor they make uſe of to cauſe them to ſtick together.

On the inner ſide of the hinder Legs of *Bees* on the joynt towards the toe, next to that on which they carry the wax, there are a great many rows of yellow ſharp pointed ſtiff briſtles, ſet all in order like the teeth of Combs for lint, which I look upon as the Inſtruments wherewith they break theſe *Globulets* and prepare their wax.

Sir *Your Affectionate Couſen*
and Servant

Aberdeen
July 17. 1685.

GEORGE GARDEN.

Hiſtoriæ